



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/693,373

10/24/2003

Yan Borodovsky

P17484

2788

59796

7590

08/28/2009

INTEL CORPORATION

c/o CPA Global

P.O. BOX 52050

MINNEAPOLIS, MN 55402

EXAMINER

CHACKO DAVIS, DABORAH

ART UNIT

PAPER NUMBER

1795

MAIL DATE

DELIVERY MODE

08/28/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/693,373	Applicant(s) BORODOVSKY, YAN	
	Examiner DABORAH CHACKO DAVIS	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 April 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 and 25-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13, 25-27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>04/09</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-9, are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1, recites "an indirect alignment apparatus to align the selected areas exposed by the second maskless patterning apparatus to a previous layer pattern instead of with the lines and spaces in the pattern formed by the first interference apparatus". The instant specification only teaches aligning the second lithography process to the previous layer pattern i.e., prior to forming the second exposed areas (second exposure pattern). The specification does not teach aligning the pattern already formed by the second lithography process with a previous layer pattern. Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 10-12, and 25-27, are rejected under 35 U.S.C. 103(a) as being unpatentable over EP 0915384 (Sugita et al., hereinafter referred to as Sugita) in view of U. S. Patent No. 5,415,835 (Brueck et al., hereinafter referred to as Brueck) and U. S. Patent No. 5,041,361 (Tsuo).

Sugita, in [0018], [0019], [0020], [0021], [0022], [0023], [0038], [0064], [0065], [0066], [0067], [0091], [0092], and in figures 15, and 19, discloses exposing a photoresist coated wafer to an interference patterns in an interference exposure apparatus (collimated and expanded laser beams, the light source is a laser), to form a periodic pattern (line and space pattern, an exposed array of patterns i.e., for positive resists unexposed lines and exposed spaces are produced), performing a second exposure in a different apparatus different from the interference exposure apparatus to form a pattern on the photoresist with a pitch twice as large as the first pitch (pitch of the interference pattern). Sugita, in [0113], discloses that an alignment optical system is utilized to observe an alignment mark (previously formed pattern) wherein the alignment mark is observed indirectly to detect the position thereof and that the position of the stage is controlled by means of a laser interferometer. Sugita, in [0073], and [0105], discloses that the second linewidth can be less than that of the first line width. Sugita, in [0021], [0022], discloses that the second exposure can be performed with masks having different patterns (claims 10-12, and 25-26). Sugita, in [0026], discloses that the second exposure can be a lens-based lithography (projection lens) (claim 27). Sugita, in [0113], [0114], [0116], discloses an alignment optical system (alignment sensor) that observes the alignment mark on the wafer for the interference pattern formed in the first

Art Unit: 1795

exposure, and observes the alignment mark on the wafer (with interference pattern formed) for the projection exposure process (second patterning system) performed on the exposed wafer. Sugita, in [0115], and in figure 21, discloses a system that enables the interference exposure apparatus (first patterning system) and the projection optical exposure apparatus (second patterning system, imprint system) to perform a first and second exposure on the wafer to form a reduced pattern on the wafer positioned on the wafer stage.

The difference between the claims and Sugita is that Sugita does not disclose a second maskless lithography process of exposing the lines that are remaining unexposed to radiation (from the first exposure) to trim and narrow the first width of at least some of the unexposed lines.

Brueck, in col 2, lines 60-68, and in col 8, lines 40-65, discloses that the second exposure pattern is re-positioned such that the unexposed portions (lines) of the resist from the first interference exposure is exposed during the second exposure and results in a second line width that is smaller than the first linewidth (i.e., the second exposure trims and narrows the first width).

The difference between the claims and Sugita in view of Brueck is that Sugita in view of Brueck does not disclose that the second exposure apparatus or the second patterning module or process comprises a maskless optical lithography tool (to perform a maskless lithography process).

Tsuo, in col 2, lines 59-68, in col 3, lines 1-12, and lines 36-42, in col 4, lines 18-21, discloses that the exposure apparatuses include an electron beam lithography tool,

Art Unit: 1795

an X-ray lithography tool, and ion beam systems. Tsuo, in col 3, lines 1-5, in col 10, lines 25-30, discloses that the exposure system includes a maskless exposure system and includes a direct write module such as an ion beam module (ion beam source), or an electron beam module (focused electron beam), and that the direct write module includes a database (connected to a computer).

Therefore, it would be obvious to a skilled artisan to modify Sugita by exposing the non-exposed areas as suggested by Brueck because Sugita, in [0113] that the alignment system is re-positionable to any desired position relative to the alignment mark, and Sugita, in [0074], and [0086], discloses that the resultant linewidth of the interference pattern formed can be reduced further by adjusting the angles at which the light beams are incident on the wafer, and by adjusting the exposure amount distribution. Therefore, it would be obvious to a skilled artisan to modify Sugita in view of Brueck by employing the exposure modules suggested by Tsuo because Tsuo, in col 4, lines 14-20, discloses that the using high energy sources such as X-rays, e-beams, and ion beams enables a resistless process to form circuit components directly in the substrate material and eliminates all the resist process steps.

5. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over EP 0915384 (Sugita et al., hereinafter referred to as Sugita) in view of U. S. Patent No. 5,415,835 (Brueck et al., hereinafter referred to as Brueck) and U. S. Patent No. 5,041,361 (Tsu) as applied to claims 10-12, and 25-27, and further in view of U. S. Patent Application Publication No. 2002/0078427 (Palmer et al., hereinafter referred to as Palmer)

Sugita in view of Brueck and Tsuo is discussed in paragraph no. 4.

The difference between the claims and Sugita in view of Brueck and Tsuo is that Sugita in view of Brueck and Tsuo does not disclose that the mask is generated from the Boolean subtraction of the final design layout from the interference pattern (claim 13).

Palmer in [0022], [0023], discloses that a Boolean subtraction of the bounded contour and the initial input is performed to obtain the mask layout.

Therefore, it would be obvious to a skilled artisan to modify Sugita in view of Brueck and Tsuo by performing a Boolean subtraction to the initial input mask data and the bounded data set as suggested by Palmer because Palmer in [0023], discloses that performing a Boolean operation enables the designer to adjust the original layout or adjust the proximity correction attributable to a particular feature that is otherwise overstated in size by too large of a degree or reduced in size or completely omitted.

Response to Arguments

6. Applicant's arguments, see Remarks, filed April 10, 2009, with respect to claims 1-9, and 10-12, have been fully considered and are persuasive. The 102 rejection of claims 10-12, and the 103 rejections of claims 1-9, 13, and 25-27, have been withdrawn. However, upon further consideration, a new ground(s) of rejection is made over claims 10-13, and 25-27, in view of Tsuo. See paragraph no. 4, above.

A) Applicants argue that neither Sugita nor Brueck, does not disclose forming interference pattern of lines with a first width with a first interference apparatus, aligning indirectly to a previous layer pattern instead of to the lines using an indirect alignment

Art Unit: 1795

apparatus, and forming without a mask (maskless lithography), features of a second width that is narrower than the first width.

Sugita discloses forming a line and space pattern i.e., the first line and space pattern has a first linewidth or width using an interference exposure i.e., in a first interference apparatus, see pages 5-7. Sugita, in [0073], and [0105], discloses that the second linewidth can be less than that of the first line width (also see figure 7B). Brueck is depended upon to disclose performing the second exposure using a maskless exposure lithography system. Brueck is not relied upon to disclose the use of an indirect alignment apparatus. Sugita teaches using an alignment optical system to indirectly detect and align (observe and position) the exposure system to the alignment mark, i.e., alignment mark is a previously formed pattern. Also see paragraph no. 4, above.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

Art Unit: 1795

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daborah Chacko-Davis whose telephone number is (571) 272-1380. The examiner can normally be reached on M-F 9:30 - 6:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Daborah Chacko-Davis/
Examiner, Art Unit 1795

August 17, 2009.